IntegraCem™ Lite Improves Well Design with Higher Compressive Strength in Fragile Formations

Technology: IntegraCem™ Lite | **Basin:** Williston | **Application:** Cementing

EXECUTIVE SUMMARY

1. Williston Basin presents several formation challenges and government requirements.
2. Exposed salt zones and low fracture gradients led to lost circulation issues with conventional cement system.
3. IntegraCem Lite provided a high strength, low density option for improved cement coverage.

OVERVIEW & CHALLENGE

This case study took place in the Williston Basin which straddles eastern Montana, western North Dakota, South Dakota and southern Saskatchewan. Within this basin also lies the Bakken Shale. Historically, wells in the Bakken are drilled and completed with long intermediate casing strings at an average total vertical depth (TVD) of 11,000 ft and mud densities from 10.5 to 11.5 ppg. However, this process exposes several salt zones and formations with fracture gradients as low as 0.64 psi/ft.

The operator needed to ensure adequate cement coverage across the Mowry formation at ~4,800 ft. The challenge was designing a system with a compressive strength of at least 500 psi while respecting both the pore pressures and fracture gradients in the formations below.

Existing wells had been cemented using a conventional lead slurry at 12 ppg with a planned top at ~4,200 ft and a tail slurry at 14 ppg with a planned top at 6,200 ft. After experiencing lost circulation issues, it was proposed to reduce the lead slurry density while maintaining the cement compressive strength.

SOLUTION

The operator consulted BJ Services and it was recommended to use IntegraCem Lite. This premium, low-density cement is lighter and has a higher compressive strength than conventional options. A dual density lead slurry was proposed using a single dry blend recipe and easily adjusted mix water fraction for density control.

This lightweight lead cement system was pumped with ~70 bbl of 11.5 ppg and ~50 bbl of 12 ppg slurry. Top of cement was planned at 4,200 ft with a 25% excess of cement volume over the gage hole volume. The tail slurry density was reduced to ~100 bbl of 13.5 ppg.

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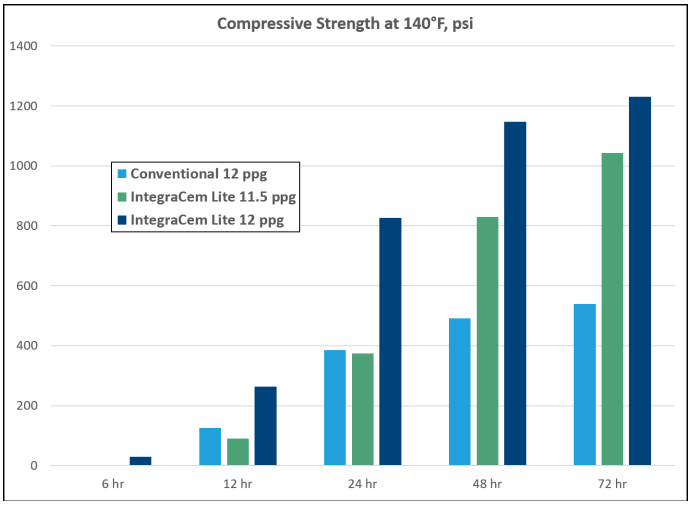
RESULTS

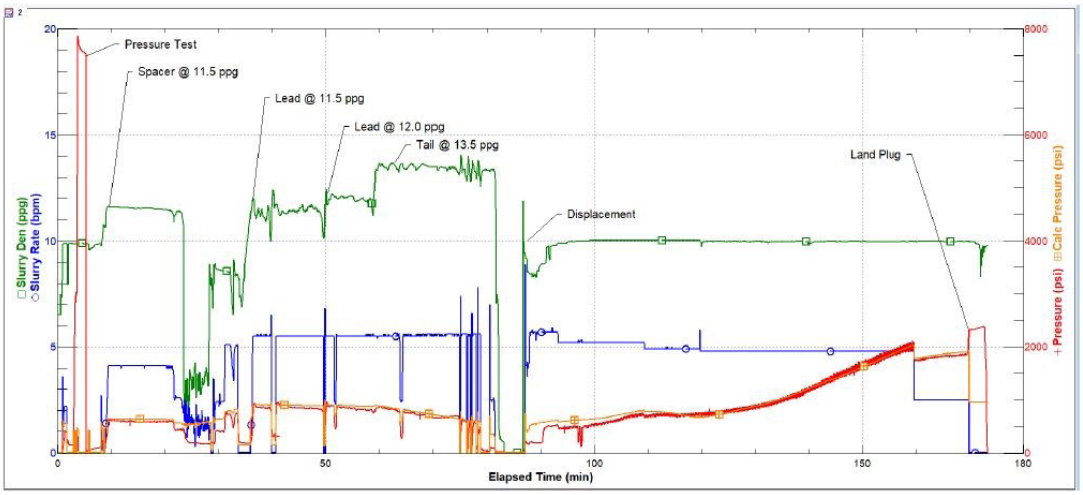
In both the 11.5 ppg and 12 ppg slurries, the compressive strength exceeded 500 psi in 48 hours and are superior to the conventional lead slurries (Figure 1).

Figure 1: Compressive strength development of conventional and IntegraCem Lite slurries



The top of cement coverage was determined successful using a job pressure match and cement bond log. They were also higher than planned due to the excess volume pumped. For all formations, the bond indices showed an improvement over conventional systems and the pressure matches showed no indication of losses (Figure 2).

Figure 2: Job plot and pressure match for IntegraCem Lite well



The IntegraCem Lite system offered the operator a cost-effective option for high strength, low density cements for the Williston Basin. It also exhibited repeatable and consistent slurry test data and field mixability. The variable density blends enabled improved cement coverage across fragile formations while it mitigated the risk of lost circulation, and the higher compressive strengths resulted in superior zonal isolation.